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PUBLIC WORKS

CITY COUNTY STATE

AUGUST 13, 1921

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Vol. 51 **AUGUST 13, 1921** **No. 7**

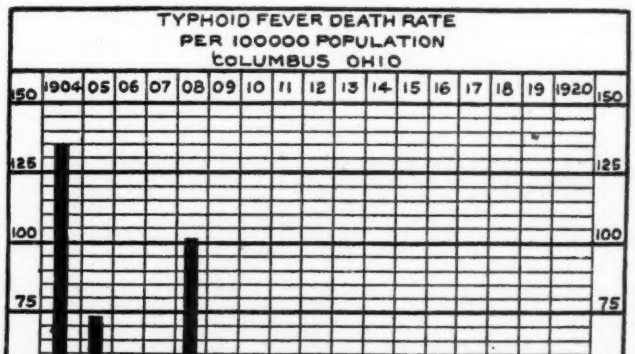
Water Softening and Purification at Columbus

Typhoid death rate reduced more than 90 per cent. Carbonate in softened water forms incrustation on filter sand. Experiments for preventing this have been tried out, and phosphoric acid seems to be the most promising.

Columbus, Ohio, is one of the comparatively few cities that soften their water supplies, and probably the only one that as yet uses phosphoric acid in connection with it, as it was, we believe, the first to manufacture its own lime and sulphate of alumina. For both of these innovations credit is due to Charles P. Hoover, chemist in charge of the water purification plant.

The city obtains its supply from Scioto river, which is dammed about five miles above the city. This water is very hard, the average for twelve years having been 160 parts per million and the hardness at times reaching 300 or more. It is also very muddy at times; after heavy rains as much as 125 tons of mud are removed from a single day's supply of water. It receives sewage pollution also, and in 1904, the year before work was started on the filtration plant, the typhoid fever death rate was 139 per 100,000; and during 1920, of all the 1 c. c. confirmatory tests of the river water for B. coli, 58.5 per cent were positive, and 96.3 per cent of the 0.1 c. c. tests, and the average number of bacteria in the river water during the year was 2,400 per c. c. By filtration the number of bacteria was reduced to an average of 19, and the turbidity was continuously zero, while by softening the hardness was reduced from an average of 266 to 109. The typhoid death rate was 2.5 per 100,000, a total of six deaths, of which five were non-residents.

Lime and soda ash are used for softening, and alum as a coagulant. The water, after receiving the chemicals, travels about a mile over and under baffles in the mixing chambers in a period of about two hours. It has been the practice at Columbus to leave between 25 and 40 parts per million of incrustant hardness in the water. During 1920 the quantity of sulphate of alumina used varied from 11.3 grains per gallon to 0.4 grain, averaging 2.3 grains.



DECREASE OF TYPHOID DUE TO FILTRATION

SAND INCRUSTATION

The normal carbonates present in the lime-softened water form incrustations on the sand grains in the filters, thus increasing the size of the sand grains and causing them to become cemented together, forming hard lumps. This condition became so bad in June, 1919, that the initial loss of head averaged 4.4 feet during the month and the average initial loss of head of the filters for the last six months of 1919 was 5.6 feet, the final loss during this period having been 12.2 feet.

The average initial loss of head during the year 1920 was 6.2 feet, and the final loss was 8.6 feet. The average initial loss of head became low in September, owing to the putting into operation of some re-sanded filters. By January 1, 1921, nine of the ten filters had been re-sanded and put back into operation.

After removing the sand and gravel from one filter it was found that the holes in the strainer plates were stopped up with carbonates; this also being a contributing cause for the poor operation of the filters. With the wash-water valve wide open the greatest vertical rise possible to obtain was 12 inches.

The strainer plates were all taken out and four ¼-inch holes drilled through each one. (There were originally 45 holes 1/16-inch in diameter.) The total area of the ¼-inch holes in the strainer plates in one filter amounts to 2.79 square feet, or 0.26 per cent of the filtering area, while the total area of the 1/16-inch holes was 1.96 square feet, or 0.18 per cent of the filtering area. With the larger openings it is possible to obtain a vertical rise of 22 inches, but on account of the capacity of the wash-water troughs the re-built filters are being washed with a vertical rise of 18 inches.

The strainer plates in the re-built filters are covered with 16 inches of gravel of the following grades, the dimensions being the diameters of circular screen openings: 5 inches of 2½ to 1½-inch gravel, 3 inches of 1½ to 1-inch, 2 inches of 1 to ½-inch, 2 inches of ½ to ¼-inch, ¼-inch of fine pea gravel and 24 inches of sand with effective size of 0.38 mm. About $20,000 is being spent in re-building the filters.

Owing to the incrustation, the sand had increased in effective size from 0.42 mm. to more than 1.0 mm. The first investigations toward working out a practical method of eliminating the difficulties were along the line of colloidal chemistry. Early experiments indicated that the solubility of calcium carbonate depended upon whether it was precipitated in a crystalline or colloidal condition. Calcium and magnesium carbonates in the former state are soluble to the extent of thirty-seven parts per million, whereas the colloid of these carbonates is soluble to more than 100 parts and colloidal precipitates form when the water is high in magnesium, or is muddy.

In order to produce a lime-softened water that would be stable, the first method which suggested itself was to carbonate the water with CO_2. There are a number of ways that the carbon dioxide may be produced, but the ones which were given particular attention were as follows:

(1) Burn the lime sludge from the settling basins, producing lime and CO_2.

(2) Treat the lime sludge from the settling basins with sulphuric acid, producing calcium sulphate and CO_2.

(3) Calcine sodium bicarbonate, producing sodium carbonate and CO_2.

(4) Treat soda ash with sulphuric acid, producing sodium sulphate and CO_2; then roast the sodium sulphate in a furnace with slack coal and limestone, producing sodium carbonate, which could be used in softening.

By carbonating the water, the normal carbonates are put in solution and there is no reduction of hardness. Under normal conditions this objection is not so serious, but during certain periods of the year when the precipitates of calcium and magnesium are necessarily colloidal, causing the alkalinity or temporary hardness of the softened water to be high, it is desirable that these carbonates be removed by precipitation, thus reducing the hardness of the water rather than be dissolved by carbonation and leaving the hardness unchanged.

Experiments were also conducted to determine the advisability of neutralizing the normal carbonates with sulphuric acid. This was effective, but was more objectionable than the carbonic acid because by this process temporary hardness is converted to permanent hardness.

Silicic acid was tried but the results were not very promising. However, excellent results were obtained by filtering lime-softened water through porous silica gel as prepared by Dr. W. A. Patrick, Johns Hopkins University.

Boric, oxalic acid, tartaric acid, and phosphoric acid were next tried and a great deal might be said of the results obtained by each of these acids, but the final conclusion arrived at was, that as a finishing treatment for lime-softened water the phosphoric acid was the best and the most economical treatment tried. When enough phosphoric acid is added to lime-softened water to combine with any caustic alkalinity that might be present in the water, and with one-half the normal carbonates of calcium and magnesium, a reaction results which produces tri-calcium phosphate, which is insoluble and readily settles from the water and CO_2 which carbonates the remaining quantity of normal carbonates. By this process half of the carbonates are removed, thus reducing the hardness of the water; the balance of the carbonates are carbonated, thus producing a water that is stable.

In coagulating muddy water, such as the Scioto river water during flood times, better results are obtained with coagulants when the water is treated with enough lime to soften the water and an additional amount is added sufficient to give the water a caustic alkalinity. This caustic alkalinity must be neutralized before the water is filtered, and phosphoric acid can be used for this purpose also.

Phosphoric acid is being tried out now on a large scale. Tennessee rock phosphate is used to make the phosphoric acid. It is boiled with sulphuric acid in one of the alum-boiling tanks, and phosphoric acid and calcium sulphate are produced. The latter is practically insoluble and separates from the solution, leaving a clear phosphoric acid which is fed into the water at the rate of about 0.7 grains per gallon.

LABORATORY TESTS

The city maintains a complete chemical and bacteriological laboratory at the water purification plant, where the water is tested, chemically, every two hours, day and night, Sundays and holidays, and bacterial analyses are made daily on samples collected at the plant and from different

points on the distributing system. Daily bacteriological tests are also made in the laboratory of the Ohio State Board of Health and at the City Board of Health. There is a chemist to control the operation of the plant and attendants for plant operation on duty every hour of the day and night.

Many of the time-consuming analytical determinations which are made daily at many water purification plants have been eliminated at the Columbus water softening and purification plant, because Mr. Hoover believes that only such tests as give assurance of the purity of the water and assist in properly treating the water should be made a part of the routine schedule, and that such tests as nitrogen, free and albuminoid ammonia, nitrates and nitrites, and the determination of dissolved oxygen, oxygen consumed, and complete mineral analysis serve to advantage only in special cases.

The analytical data necessary to determine approximate quantities of lime and soda ash required to soften a hard magnesium water, such as the Scioto river water, are:

Free CO_2.

Half bound CO_2 (44 per cent of the alkalinity).

Total magnesium.

Permanent hardness or incrustants.

The methods of analysis used are the Standard Methods of Water Analysis of the American Public Health Association.

During the year 1920 the total consumption was 8,275 million gallons (calculated from pump counters with 1 per cent allowance for slip), giving 94 gallons per day per inhabitant, or 97.8 per consumer. The cost of supplying water per million gallons pumped, on basis of total operating expense, was \$64.09, or \$89.46, including interest on bonds and sinking fund charges. The cost per million gallons pumped was \$19.45 for chemicals for purifying and softening, \$8.81 for coal at the pumping station, and \$29.09 for labor for operating and maintaining the entire plant. The total cash receipts from all sources was \$92.89 per million gallons pumped. The average net amount received for water per service was \$18.35 and the average total cost of operating plant plus interest on bonds and sinking fund charges was \$19.21 per service.

The total cost for purification and softening was \$221,438, of which \$170,745 was for materials and \$50,693 for labor, and \$19,039 was spent for construction in connection with the same.

Clinton Bridge

A state highway bridge at Clinton, Conn., has three 40-foot spans and two 16-foot end spans of concrete T-beam construction, supported on concrete pile trestle bents. The outer edges of the outside sections of the floor slabs are moulded to give the effect of fascia girders and form a suitable base for the concrete parapets which form continuous handrails or ballustrades on them.

The floor slabs are supported on the transverse concrete caps of trestle bents, composed of a pair of cast-in-place concrete piles, 16 inches in diameter, which are of special construction in order to secure protection against the action of the salt water in which they are immersed.

The bents are located in shallow water in which the bottom was dredged to provide a satisfactory regular horizontal surface to receive extended footings. Each trench was enclosed with a simple cofferdam sufficient to protect the interior from the effects of tide and current, but was not watertight. In it there was deposited under water a concrete footing 2 feet thick and before this had set there was placed at each end of the footing a section of 36-inch tile pipe bell end down, and penetrating slightly below the surface of the soft concrete. This pipe was used as a form and was filled with concrete, after which a second length of pipe, bell down, was placed on top of it, concreted, and so on, until the pile was built up to the required height.

The arrangement with the bells down provided a slightly larger base on the footing and prevented any accumulation of salt water in the bells. The pipes served not only as convenient sectional forms, but are also permanent protection against action of salt water on the concrete.

The bridge was built by John D. Holbrook, contractor, under the direction of the Federal State Highway Commission.

THREE 40-FOOT REINFORCED CONCRETE GIRDER SPANS ON CAST-IN-PLACE CONCRETE PILE BENTS

To Clean Up Elizabeth River

Elizabeth river, where it flows through Elizabeth, N. J., has been growing increasingly obnoxious for several years past, due to the decomposition of sewage matter which is discharged into it from the city sewers and also to the presence of oil and other offensive matters originating on abutting properties. James H. Fuertes has recently submitted a report to the Board of Works of that city on the abatement of these nuisances, recommending the expenditure of $3,877,000 for both immediate and future construction.

The immediate steps recommended are constructing two intercepting sewers at an estimated cost of $20,300, dredging sewage sludge from the river bottom at an estimated cost of $16,500, and making some changes and extensions in the sewerage system at an additional cost of about $10,000. Ordinances preventing pollution of the river by oil and other commercial wastes should be passed and enforced.

Work which should be performed from time to time in the future include widening the river at many points and especially between bridge abutments by lengthening the bridges; separating the storm sewage from house sewage, and regulating all future sewer construction to provide for ultimate treatment of the sewage and obtaining a site for a sewage treatment plant.

The condition in the river is aggravated in warm weather by the fact that the Elizabethtown Water Company, during dry periods, uses practically the entire flow from the river. Last summer there were ten days during which no fresh water flowed below the dam and twenty-four days during which the flow was less than 1,000,000 gallons a day. As the sewage flow of Elizabeth is about 14,000,000 gallons a day, the flow of the river furnished practically no dilution. The object of the sewers recommended by Mr. Fuertes is to carry all of the putrescible matter to an outlet below the city, ultimately treating all sewage before discharging it into either the river or Newark Bay. Up to the time of this writing no action had been taken for an immediate carrying out of any of these recommendations.

Gate Valve Controls in Cambridge

The Cambridge, Mass., municipal water works pumps water from Fresh Pond through a 40-inch force main to a reservoir from which a 40-inch main supplies the distribution system. There is also a 36-inch main by-passing the reservoir to the distribution system.

As is the case in most other cities, the large 40-inch and 36-inch valves on these lines have seldom been operated and receive little attention, and General Superintendent Timothy W. Good, to whom we are indebted for this information, says that: "Experience shows that on former occasions when it was necessary to shut down, it took eight men three hours to close these valves."

Recently, the city installed three gate valve controls on the valves on these lines. "By pressing a button on our new system we have our force main gate and our distributing main gate closed, and our connecting gate opened, all in a period of seven minutes. . . . The gates were installed at this particular point so as to control our entire system in case of emergency. If any trouble occurs between this point and our reservoir, or our reservoir should start leaking or be shut down for any other cause, we could immediately close the force main, close the distributing valve, open our 36-inch connecting gate and send the water direct through our system."

The city expects in the near future to have every gate more than 20 inches in size electrically operated, and is preparing a contract with the Payne Dean Co. for equipping four more of the large gates at once. Says Mr. Good: "I feel that it is money well expended, as when emergency now arises we know that considerable damage could be done during the time it takes to close the valves, which have not been operated recently, but with electrical control and proper inspection system of same, all water can be shut off from any section of the city in five to seven minutes.

"Of course, these electrical devices must be properly cared for and I have instituted a system of weekly inspection by our engineer and foreman and close these three gates at least once a week. I would say that they are working perfectly and I would be very glad to recommend them for use in any water department."

The Construction Industry*

The national wealth of the United States in 1920 is authoritatively estimated at about $290,000,000,000, of which the two largest items are about $169,000,000,000 value of real property and $20,000,000,000 the interstate commerce commission valuation of railroads and equipment, besides which there are about $7,000,000,000 for street railways, about $2,000,000,000 for telephone and telegraph systems, a little more than $2,000,000,000 for shipping and canals, and $3,248,000,000 for privately owned central electric light and power stations.

The 266,000 miles of railroads represent construction costs of about $15,000,000,000, the 80,000 miles of pavements and highways in cities cost about $4,000,000,000 and the estimate for highway construction during 1921 alone is more than $1,000,000,000.

An analysis of the United States government's figures indicate that construction represents 25 per cent of the total national wealth, 25 per cent of the 276,000 manufacturing companies that employ 10,613,000 workers to whom they pay more than $5,000,000,000 wages annually for the production of a $25,000,000,000 output.

Construction takes 90 per cent of iron, copper and lead output, 20 per cent of bituminous coal and 25 per cent of all freight. It requires 50 per cent of new capital issued, 24 per cent of annual capital accumulation and 50 per cent of national savings.

During 1920 nearly $3,000,000,000 of new securities were issued for construction without counting a large amount of construction that was

*Abstract of Report of Committee on Statistics of U. S. Chamber of Commerce.

financed out of any surplus without issuing securities.

A report of the Senate Committee of reconstruction and production estimates that from $10,000,000,000 to $20,000,000,000 is necessary to provide for structural facilities which would now be in use if there had been no war.

A present expenditure of about $35,000,000,000 would be necessary in order to develop our railroad system to serve each square mile of territory as thoroughly as is done in Germany and the United Kingdom. The necessity for enormous construction now exists and will continue for a long time.

CASTING REINFORCED CONCRETE PILES ON PLATFORM IN CONTRACTOR'S YARD

Concrete Bridge Foundation Piles

The pier foundations for the Washington bridge across the Housatonic river, between Milford and Stratford, Conn., are made with about 1,000 reinforced concrete piles, 14 inches square and averaging 40 feet in length, that support the footings concreted under water.

T. Stewart & Sons, contractors, West Newton, Mass., cast the piles in single tiers, on platforms 60 feet long at the river bank, near the bridge site. The vertical sides of the forms were set up on the smooth surface of the platform and between them were placed the reinforcement steel bars, assembled to form frames securely wired together and handled as units.

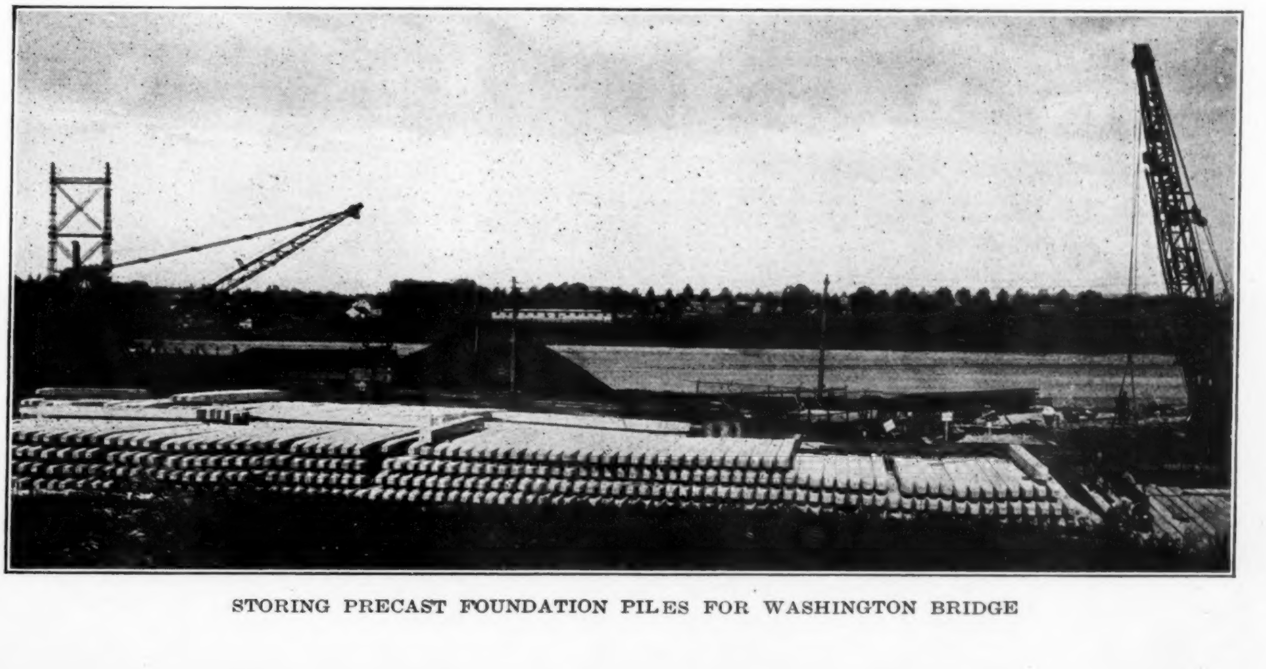
After the concrete was 6 or 7 days old the piles were stripped and carefully handled by a locomotive crane that transferred them to storage, where they were piled several tiers deep and left for a month or more before they were driven.

Steel staples with bent ends were cast in the upper surfaces of the piles, projecting beyond them to provide attachment insuring the connection of the hoisting tackles at the proper points. One was placed near each end of the pile and was quickly connected to the ends of a long evening bar, attached to the hoisting tackle of the crane. The lower ends of the piles were pointed and at the upper ends the dates and lengths of the piles were marked so as to be always visible when the piles were stored on the skids in the seasoning yard.

The piles were delivered on scows to the floating pile driver and were driven to an average penetration of about 40 feet through mud, earth and gravel, at a rate varying from 8 to 60 piles per 8-hour shift. A follower was provided for driving the piles below water surface. The bridge was designed and the work was done under the supervision of the State Highway Commission, Charles J. Bennett, commissioner, and R. L. Saunders, deputy commissioner, in charge of construction.

To Inspect New Jersey Dams

Official notice of the inspection of the dams of New Jersey was given July 26 by the State Department of Conservation and Development. Authority for this inspection and the control and regulation of all dams is given by the act of 1912. Heretofore the work has been limited by lack of funds. The appropriation for dam inspection and water supply investigation is $30,000.



STORING PRECAST FOUNDATION PILES FOR WASHINGTON BRIDGE

Alfred Gaskill, director of the department, has requested boards of freeholders to submit lists of dams which should have first attention. Obviously a state-wide inspection of all existing dams cannot be made at once, and these lists from the counties will enable the department to work to the best advantage and accomplish that which is most urgent in the shortest possible time.

Improving Building Construction

Annual losses of $500,000,000 in wages and of 12,000,000 days due to accidents should be largely eliminated, the union policies amended, work be better planned, and better co-operation secured between employers and employees.

The American Engineering Council has issued extracts from the report of its Committee on the Elimination of Waste in Industry, that emphasizes most of the troubles generally acknowledged, points out others not so well known, gives an authoritative estimate of their importance and suggests various rational methods of correcting the evils so as to vastly increase the amount, improve the conditions and promote the economy of general construction.

The report states that the primary causes of waste in the building industry are irregular employment, inefficient management, and wasteful labor regulation. Local customs, conditions and poor equipment are secondary causes.

Irregular employment is due to seasonal fluctuations, bad weather, strikes and lockouts. Obviously, arrangements should be made to perform indoor work as much as possible in stormy weather; to avoid exposed work in inclement weather; to distribute routine work as much as possible through the year; and to encourage winter construction by careful planning of methods and schedules, by co-operation with local transportation and material men, by co-ordination with labor, and by the acceptance of lower wages and smaller profits in return for the benefits of continuing operations during the winter and avoiding an idle season.

The strike is one of the greatest economic wastes in this industry and is generally caused by demands for increased wages or the recognition of the union, decrease in the working hours, and by jurisdictional disputes. In most cases the prime factor is the lack of understanding and failure of the employers and workers to get together. If the greatest cause, the demand for increased wages, could be eliminated, strikes would shrink into insignificance.

Co-operation between management and labor is necessary to determine a minimum wage to correspond with a standard amount of production with additional compensation for additional output. The union must co-operate to the extent of eliminating the flat rate for all mechanics of the trade and the restriction that forbids mechanics to accept piece work. Old methods should be replaced by new ones, definite records kept of accomplishment, and scales of wages based upon quality and quantity of work done and standards of a proper day's work should be established.

Inefficient management is due to failure to furnish continuity of employment; failure to plan work in sufficient detail; failure to provide detail plans in time; lack of proper schedules to allow co-ordination of purchasing and delivery to suit the job requirements; lack of standards; disregard or ignorance of high cost of labor turnover; or failure to use proper amount and type of equipment for operation.

Wasteful labor regulations consist of requiring men to do skilled work that could be performed by unskilled men, restricting individual incentive by uniform wages, limiting the number of apprentices, restricting output, excessive reduction of working hours, and jurisdictional restrictions.

Great direct and indirect injury is done the construction interests by accidents that destroy life and property and delay the work. Their cost, computed on the insurance alone, is 2½ per cent of the total labor cost and in some construction trades rises to 10 per cent of the labor cost and is believed to average much more than is indicated by this single factor. Construction accidents are largely caused by carelessness of workmen or lack of ordinary safeguards and it is believed that it is entirely practicable to reduce the loss sustained through them by from 75 to 80 per cent with less than five years of honest effort, which would probably save 12,000,000 days' time per year.

Acceptable Risks for Surety Companies

An article in the July number of the bulletin of the Associated General Contractors of America discusses the viewpoint of the bonding companies for construction work, and concludes that they discourage too low or too high bids and, very rationally, prefer that the contractor for whom they are sureties should know his business, make reasonable bids, and have sufficient equipment together with sound finances and integrity.

The premium charge upon the bond of the contractor for the surety company's guarantee of his finances and skill is just as properly an item of the cost of the work as the labor, materials or supplies, and from it the surety company does not make a net profit to exceed 1 per cent, although it may lose heavily.

Their usual criterion is that the applicant shall have cash on hand equal to 10 or 15 per cent of the amount of the work undertaken, where estimates of 85 or 90 per cent of work done and materials covered are paid monthly or semi-monthly.

The contractor should have other assets, such as unpaid balances for work performed, accounts receivable and other items that may serve as collateral for bank loans; should have real estate and sufficient good equipment; should have experience in successfully handling similar work; and should not be obligated for too many jobs for his capital.

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Activated Sludge Process to Date

An excellently comprehensive and clear statement of what is now known concerning the activated sludge process, as to its principles of action, the results obtained and difficulties yet to be overcome, is given in the paper by Harrison P. Eddy, begun last week and concluded in the present issue. Much of interest and valuable information can be found in this article by any interested in the subject, with the possible exception of the half dozen or so who are already familiar with every feature and detail of the investigations made and results obtained in connection with this method of sewage treatment both in this country and abroad.

Considering the number of years that activated sludge has been under investigation and the interest taken in it, the number of plants in active operation is exceedingly small, and many may wonder why this should be the case, remembering the rapidity with which septic tanks were built all over the country fifteen or twenty years ago, when that was the leading treatment method. The explanation probably lies in the cost of both constructing and operating the activated sludge plants, with the difficulty and uncertainty connected with the handling and utilization of the sludge as an additional cause.

During a discussion of the subject at the latest convention of the American Society for Municipal Improvements, some interesting points were brought out by the sanitary engineers present. In the matter of cost, Langdon Pearse reported that a comparison of the cost of sprinkling filters and of an activated sludge plant for a city of 50,000 population in Illinois, gave the cost of a sprinkling filter as $630,000 and of an activated sludge plant as $540,000; but the operation of the former would cost only $21,000 a year while that of the activated sludge plant would cost $81,000, or, with certain allowances for economies and sale of sludge, possibly $56,000; exclusive of interest in each case. These figures were based on a cost of two cents per k. w. h. for power. Mr. Pearse concluded that "there is no chance, with our present conditions, on this size of plant, to bring the cost of activated sludge down to a par with tanks and sprinkling filters on a total annual charge."

T. Chalkley Hatton stated that they estimated for Milwaukee that the cost of operation would be $2 per million gallons more for activated sludge than for sprinkling filter, after crediting the former with $18 as the estimated value of the activated sludge produced, this including interest, sinking fund and other overhead charges.

As to sludge difficulty, Mr. Pearse said that this was not now so much a matter of machinery but of conditioning the sludge so that the water can be extracted readily. In Houston, however, after having been pressed, the sludge is a very sticky substance which cannot be handled by conveyors as it gums them up and will not drop off of them at the end of the conveyor run.

Inevitable Requirements

A serious joint consideration of the articles in this issue on the construction industry and on improving building construction must lead not only to overwhelming conviction of the tremendous present and future construction opportunities that cry aloud to be accepted and developed for almost unlimited wealth and prosperity, but also to a better realization of the sinister influences that, stimulated by profiteering, politics, and war emergency, have offset favorable economic, industrial, and financial conditions so much that a vast amount of the possibilities are still unrealized and in danger of depreciation.

Many of the brilliant prospects of 1920 which were fully justified have been retarded and some have been seriously injured by failure to resume sound conditions that were indispensible to the full prosperity of 1921. In order to provide for the splendid opportunities of 1922 that offer almost incredible rewards for enterprise and capital it is necessary to effect a nation-wide revision of bad practices and remove the principal difficulties that have this year needlessly blocked adequate

resumption of construction. These have been recognized, admitted or excused accordingly to the intelligence, fairness or courage of the individual. The essential factors, previously more or less well known, have now been impartially weighed, compared, and analyzed and it is established that we have well within our reach the principal essentials for rapid and enduring construction prosperity.

The vital elements include regularity and continuity of employment; increased and improved mechanical equipment; fair labor regulation; labor union reform; more accurate and rational construction management; abolition of wasteful labor regulation; increase of apprenticeship; increased working hours; reduction of labor turnover; and the prevention of waste and loss of human life due to preventible accidents.

Let construction associations and individuals, financial and industrial interests, and representatives of labor vigorously maintain an honest and sincere effort to establish these improvements and there will be no delay in the flood tide of engineering construction in this country.

Lights and Shadows of the Activated Sludge Process*

By Harrison P. Eddy

Preliminary fine screening. Removing floc. Disposing of sludge. Possible improvement.

PREPARATORY TREATMENT BY FINE SCREENING

A very important advance has been made by demonstrating that it is possible to remove sufficient of the heavy and coarse solids of strong municipal sewage, by means of grit chambers and fine screens, to prevent the accumulation of deposits upon diffuser plates which are supplied with air at the rate of 1 cubic foot per minute per square foot of plate area. This assures the successful operation of aeration tanks which prior to this demonstration was open to some question in cities where there is a very large proportion of heavy settling solids.

There is opportunity for further investigation to determine whether the quantity of air required can be materially further decreased by screening finer than that which has already been employed. This would appear to be a promising field for study.

In some cases—particularly where industrial wastes, such as those from tanneries and packing houses are present—the advisability of sedimentation as a means of preparing the wastes for aeration, is worthy of careful consideration. Some such wastes contain very large quantities of coarse and heavy suspended matter, and it is possible, and in some cases probable, that preparatory sedimentation may result in a substantial saving in air and may possibly also be so important as to make the process practical where without such preparatory treatment it might prove impractical.

*Continued from page 115. Paper before the Western Society of Engineers.

SEDIMENTATION—REMOVING FLOC

Obviously it is necessary to remove the floc in order to produce a satisfactory effluent—it would be folly after having gone to the expense necessary to form the floc, to allow it to escape with the effluent and thus nullify the work done in the first stage of the process.

The character of the floc—whether of light weight and voluminous due to under-aeration or low temperature, or heavy and compact as a result of thorough aeration under favorable conditions—has an important, if not vital, effect upon the sedimentation process. If the floc is light and voluminous it settles less rapidly, is more easily carried over the weirs in the affluent, and, most important of all, it fails to consolidate and become compact as it accumulates in the tank. Generally a well-activated sludge settles very rapidly and forms a relatively compact or dense sludge.

A good floc may form a sludge containing as much as 3 per cent solids and readily form one of 2 per cent, while a light, fluffy floc will often produce a sludge of 1 per cent and sometimes of only ½ per cent solids. The difference between sludges from under-aerated and well-aerated sewage is readily appreciated when the volumes of sludge to be handled are considered. The volumes which commonly occur, based upon a uniform quantity of suspended solids, are given in Table 1.

Table 1—Relation of Volume of Sludge to Proportion of Total Solids

(Original Sludge 2 per cent total solids; dissolved solids 800 p. p. m.)

Water in Sludge,	Total Solids in Sludge,	Suspended Solids in Sludge,	Relative Vol. of Sludges of diffr't Densities,	Vol. of Sludge to be returned to afford Uniform Quantity of Suspended Solids, Gal.	Vol. of Sludge to be Wasted Gal. p. M. G.
%	%	%	%	p. M. G. Sewage	Sewage
99.5	0.5	0.42	100	909,000	68,200
99.0	1.0	0.92	46	418,000	31,400
98.5	1.5	1.42	30	273,000	20,500
98.0	2.0	1.92	22	200,000	15,000
97.5	2.5	2.42	17	155,000	11,600
97.0	3.0	2.92	14	127,000	9,500

The volumes of sludge to be returned and wasted, as indicated by Table 1, are based upon the assumption that these volumes will be equivalent to 20 per cent and 1.5 per cent, respectively, of the sewage treated when the sludge contains 2 per cent total solids.

The importance of providing a relatively dense sludge is obvious from these data. If 20 per cent of sludge containing 2 per cent solids be required for the successful treatment of the sewage in the aeration tanks, and if for any reason the density of the sludge is suddenly changed to 0.5 per cent solids, the volume which must be pumped into the sewage to furnish the same quantity of suspended solids will be increased from 200,000 to 900,000 gallons per million gallons of sewage to be treated, and all portions of the plant devoted to aeration, sedimentation and sludge return, must have capacities for this greater quantity, if the density be permitted to fall to this extent. Similarly, were

it assumed that sludge having 0.5 per cent solids can be dewatered with equal facility to that having 2 per cent solids, equipment must be provided for handling 68,200 gallons of thin sludge per million gallons of sewage, instead of 15,000 gallons of normal sludge containing 2.0 per cent solids. Furthermore, the indications are that thin under-aerated sludge is not as easily dewatered as normal well-aerated sludge. From the foregoing discussion it is clear that the success of the activated sludge process depends in large measure upon the production of a good floc and its efficient removal. So important is this phase of the treatment that it may well prove the controlling feature, and it may therefore be necessary to operate the plant primarily for the production of a good floc providing such quantity of air and period of aeration as may be required for this purpose even though the quality of effluent produced be better than necessary.

In proportioning sedimentation tanks, four requirements should be kept in mind:

1. Opportunity must be afforded between the point of entrance and the point of exit for the floc to settle sufficiently to prevent its being carried out of the tank with the effluent.

2. The rate of sludge withdrawal must be such as to retard the travel of the floc enough to permit it to consolidate and form a relatively dense sludge.

3. There must be provision for drawing the sludge with sufficient rapidity to prevent its being delayed in passage to such an extent that it will undergo septic action which will render it less suitable for the treatment of the incoming sewage and particularly unfavorable for dewatering by methods now in use.

4. There must be sufficient tank capacity to provide space for the accumulation of the floc, which varies greatly from time to time during the day, according to the variation in the strength of sewage, as well as to other conditions, and also for the accumulation of the abnormally voluminous floc during brief periods of cold weather or under-aeration, neither of which can be entirely counteracted or avoided.

As stated by Mr. Hatton, the proposed Milwaukee sedimentation tanks have been designed to receive aeration tank liquor at a rate sufficient to produce 1,600 gallons of effluent per 24 hours per square foot of gross internal tank area at times of maximum flow. The average rate of flow in dry weather will be about 850 gallons per square foot. In the demonstration plant the sedimentation tanks have received as much as 2,000 gallons of aeration tank liquor for substantial periods of time during which the effluent was satisfactory. The more conservative allowance for design was adopted in order to provide for contingencies, such as a light fluffy sludge and changes in volume and quality of sewage. Some of these conditions may be coincident and last for a substantial length of time, as for example, in the spring when snow is melting the flow of sewage is high and its temperature is low.

Tests indicate that the floc from municipal sewage and from some industrial wastes may be concentrated readily to a sludge containing 2 per cent, and under favorable conditions possibly as high as 3 per cent solids. To secure a greater concentration requires storage for so long a time that there is danger of septic action with its attendant evils. The safe limit of such storage may perhaps be taken at 6 hours, until such time as more data bearing upon this specific point become available.

SLUDGE LAGOONS

One of the most interesting developments is the disposal of sludge by pumping it into lagoons at Houston, Texas.

At the South Side plant, which was started in August, 1918, all of the sludge produced up to the time this plant was visited by the writer in July, 1919, had been pumped into one lagoon which was about 300 feet long, 100 feet wide and 7 feet deep, with side slopes of about 1 on 1½. At that time there was no offensive odor from this lagoon. There was, however, the characteristic odor of algae, which appeared to be growing in considerable quantities. No water had been drawn off from the lagoon, the supernatant water was clear, many gas bubbles were being given off, and some sludge was being carried to the surface by the gas bubbles, but immediately subsided. There was no floating sludge.

At the North Side plant, where the sludge had been run into three lagoons, conditions were substantially the same.

SLUDGE DEWATERING

Perhaps the darkest spot in the entire process of activated sludge treatment is that of sludge dewatering, which has been studied at the Packingtown, Houston and Worcester plants, and particularly by investigations covering a period of several years at the Milwaukee testing station. Notwithstanding all of the investigational work thus far done, this problem cannot be said to have been satisfactorily solved at the present time.

It has been repeatedly demonstrated that well-activated sludge can be dewatered more advantageously than an under-aerated or a stale septic sludge. It is accordingly necessary to so operate the plant, insofar as practicable, to avoid under-aeration, prolonged storage which tends to cause septic action, and probably also over-aeration which tends to resolve the floc into its colloidal condition. It is probable that the plant must be operated with a view to producing the sludge in a condition to be most readily dewatered, although there is promise that a poor sludge can be conditioned so as to be successfully dewatered.

Table 2.—Nominal Volume of Sludge Produced by Different Processes of Sewage Treatment

Treatment Process	Nominal Vol. of Sludge, gal. per mil. gal. of sewage treated	Proportion of Solids in Sludge	Spec. gravity of Sludge	Wt. of dry solids in sludge, lb. p. mil. gal. of sewage treated
Activated Sludge	10,000	2.00	1.005	1,675
Chemical Precipitation	5,000	7.50	1.040	3,250
Sedimentation	2,500	5.00	1.020	1,060
Septic Tank	500	5.00	1.040	220
Imhoff Tank	500	15.00	1.070	670
Trickling Filter—Humus Tank	500	7.50	1.025	320

One phase of the magnitude of the sludge disposal problem may be readily appreciated by a comparison of the nominal volumes of sludge produced by the several processes of sewage treatment now in use, Table 2.

While it is recognized that the volume of sludge produced by any of these processes will vary materially according to local conditions, and particularly to the proportion of solid matter removed from the sewage, the activated sludge process, under all conditions, is likely to produce a very much greater volume of sludge than any other process.

For the dewatering of activated sludge consideration may be given to the use of four types of machines—the plate or standard filter press, the squeeze press commonly known as the Worthington or Berrigan press, the Schaefer-ter-Meer centrifuge and the Besco-ter-Meer* centrifuge.

The plate press consists of a large number of thin round or square cast iron plates, concave on both sides, supported in vertical position upon two horizontal side rods. The plates are covered on both sides with cotton duck and when forced tightly together in closed position, form thin chambers into which the sludge is pumped under a pressure of about 100 pounds per square inch. The water of the sludge is forced through the duck and escapes by means of corrugations on the faces of the plates and holes cored in them. The solids are retained upon the cloth and gradually form a very compact cake. After the cake has begun to form in this manner, the water must pass through it as well as through the cloth in order to escape. When the sludge is fresh, well-activated and in most favorable physical and chemical condition, a cake about 1 inch thick may be formed in about two hours. Under such conditions the cake is easily separated from the cloth, leaving it relatively clean for the next pressing. Under other conditions the sludge has entirely different characteristics and may require 4 or 5 hours for the formation of a cake and even then the cake may be so moist that it cannot be removed without leaving the cloth smeared with slimy sludge and in poor condition for further use, if indeed it can be so used without previous washing. The sludge may be in such condition that its dewatering by this method is impracticable.

The squeeze press is of entirely different construction and operates upon a different principle. In this case a number of bags, open at the bottom, are held in position by supports at the top. Between each pair of bags is a corrugated drainage rack, also supported at the top. Preparatory to filling, the bottoms of the bags are forced tightly together to prevent the escape of liquid sludge, which is then allowed to flow by gravity or under slight pressure into the bags, through small flexible tubes attached to a sludge pipe header at the top. During the filling, which is done slowly, a portion of the water escapes through the cloth. When the bags have become filled, the sludge supply is shut off and pressure is applied to all the bags by means of two end platens which are forced toward each other under considerable pressure, thus squeezing the bags and forcing the water out through the cloth, whence it escapes through the vertical corrugations in the drainage racks. In this way the water is squeezed out of the sludge in a manner similar to that employed in the home-made "jelly bag," leaving a rather homogeneous mass of moist solids. There is no formation of compact cake on the inner surface of the cloth, as in the case of the plate press. When the sludge is in favorable condition the pressing may be completed in approximately 4 hours. Dewatering by this type of press does not appear to be so greatly affected by unfavorable condition of the sludge as in the case of the plate press, although the time of pressing is materially increased and the cake usually contains more moisture.

In the original Schaefer-ter-Meer centrifuge the sludge is admitted to a revolving drum which is closed at the top, and is subdivided into radial compartments each of which has a perforated plate or screen through which the water is thrown by centrifugal force. The solids form a cake on the perforated wall of the chamber, in much the same manner as the cake is gradually formed in the plate press. The water must pass through this cake in order to escape.

The Besco-ter-Meer centrifuge is similar in general mechanical construction to its predecessor, the Schaefer-ter-Meer, except that the drum is open at the top and is not subdivided into compartments. There are no screens or perforations. In this case the solids are thrown, by centrifugal force, against the wall of the drum, where they gradually build up a cake, leaving the water in the center of the drum to be thrown upward and over the top by centrifugal force. In this type of centrifuge it is obvious that it is not necessary to force the water through the cake, as in the case of the Schaefer-ter-Meer centrifuge or the plate press.

Experiments with Besco-ter-Meer centrifuge show that it is possible to secure a cake of from 80 per cent to 85 per cent moisture. However, the centrifuge effluent contains a very large proportion of the original suspended solids—from 80 per cent to 50 per cent. There seems to be a segregation of solids, the larger and heavier particles being formed into cake and the lighter and finer matter remaining in the effluent.

It is extremely difficult to remove this residual matter by subsequent centrifuging either by itself or when mixed with fresh normal sludge.

ACIDIFICATION OF SLUDGE

Activated sludge is normally slightly alkaline and it has been found that its natural slimy characteristics can be counteracted in a measure by acidification. The quantity of acid required will vary according to conditions, but in general, if sulphuric acid is used it may be taken at about 0.12 per cent by volume of the sludge to be dewatered. If it be assumed that the waste sludge will be equivalent to 1.5 per cent of the sewage treated, or 15,000 gallons per million gallons of sewage, the quantity of sulphuric acid required, upon this basis will be about 1.2 gallons per thousand gallons of sludge, equivalent to 270 pounds

*A modification of the Schaefer-ter-Meer centrifuge deriving its modication in name from the Barth Engineering and Sanitation Company, American agents.

of commercial sulphuric acid per million gallons of sewage. At 1 cent per pound, the cost of acid will be about $2.70 per million gallons of sewage treated.

The cost of acid may be offset in part, or perhaps wholly, by an increase in ammonia content of the dried sludge. This is because of the neutralization of the alkalis with acid, after which heating in the drier does not drive off the nitrogen in the form of ammonia, as is the case when unstable nitrogeneous compounds are heated in the presence of alkalis. The gain in ammonia due to acidification, while varying in different sludges, may be taken at about 12 per cent.

There is likely to be another apparent increase in the ammonia content of the dried sludge, due to the effect of pressing, by which a substantial proportion of the solids in the sludge pass away in the form of press liquor. The proportion of nitrogen in these solids is somewhat lower than that in the suspended matter, due to the large proportion of colloids high in nitrogen in the latter. The removal of the dissolved solids, therefore, results in an increase in the proportion of nitrogen in the dry solids of the sludge cake over that in the dry solids of the original liquid sludge.

The effect of the apparent increases due to acidification and to pressing, when applied to the dried sludge containing 10 per cent moisture and computing the value of the sludge at $4 per unit, are shown in Table 3.

Table 3.—Estimate of Quantity and Price of Fertilizer from Strong Municipal Sewage*

Volume of sludge, per m. g. sewage	15,000 gal.	
Proportion of dry solids	2%	
Weight of dry solids per m. g. sewage	2,500 lb.	
Wt. fertilizer with 10% moisture.2,780 lb. equals	1.39 tons	
Proportion of ammonia in dried unacidified sludge containing 10% moisture (6% ammonia on dry basis)	5.4%	
Increase in ammonia, due to acidification	12.0%	
Ammonia in dried acidified sludge	6.05%	
Increase in ammonia due to pressing	9.0%	
Ammonia in dried acidified press cake	6.59%	
Price per unit of ammonia	$4.00	
Value per mil. gal. of sewage—		
Fertilizer—nominal—unacidified, unpressed, dried	$30.02	
Fertilizer — nominal — acidified, unpressed, dried	33.64	
Difference, due to acidification		$3.62
Fertilizer—acidified, pressed, dried	36.64	
Difference, due to pressing		3.00

*No allowance for losses.

It therefore appears that there is a theoretical increase in value of $3.62 per million gallons of sewage, due to acidification. If the price be taken at $2 instead of $4, per unit of ammonia, the difference would be but $1.80—hardly enough to pay for the acid.

Present indications are that the return from the sale of fertilizer will partially, and perhaps wholly, offset the cost of dewatering and drying the sludge, but that there will probably be no surplus applicable to the operation of other features of the plant.

SLUDGE DRYING

Sludge drying is similar to the drying of many other materials, which has been thoroughly developed in the arts. There does not seem to be any problem peculiar to the drying of sludge. There is, of course, the danger of burning the sludge, of creating objectionable odors, and of the escape of considerable dust. Care in manipulating driers designed for the purpose should reduce to a minimum the liability of burning or scorching the sludge. If the gases from the driers are passed through suitable dust chambers and are thoroughly washed, dust can be entirely eliminated and there does not seem to be danger of dissemination of disagreeable odors. It will, however, be advisable to discharge the washed gases through a relatively high stack.

MANAGEMENT

One of the most serious inherent dangers in the application of this process lies in its management. The process is complicated by a large number of steps, each more or less dependent upon the preceding one. Skilful, conscientious, technical management will be required to keep all features operating to best advantage, with the marked variations in volume, character and temperature of the sewage, and the multitude of ordinary operating difficulties.

It remains to be demonstrated whether such a process can be successfully operated as a commercial project under municipal conditions generally prevailing in the United States. To assure success it will be necessary to enter the market and dispose of the commodity produced as advantageously as the laws of supply and demand will permit. Prices are subject to radical fluctuations, but the costs under municipal control will probably not fluctuate in a commensurate manner. The one thing which is assured from the outset is a very substantial cost, but it may be hoped that enough revenue will be derived to so reduce operating expenses as to prevent them from becoming an unreasonable burden.

TWO IMPORTANT ADVANTAGES

There are two very important advantages of the activated sludge process—the production of a well-purified effluent of attractive appearance, and the complete disposal of the sludge. These advantages are well worth striving for. At present it would seem that this process is particularly worthy of consideration where such an effluent is desired, and where power may be obtained at moderate cost. Obviously it is an advantage for such a plant to be situated in a district where large quantities of fertilizers are used, thus avoiding the necessity of shipping the sludge long distances.

OPPORTUNITIES FOR IMPROVEMENT IN PROCESS

There appear to be two features which give promise of great improvement, on further investigation—the aeration and agitation of the sewage, and the dewatering of the sludge. It may be that the former can be accomplished by some sort of mechanical agitation accompanied by the use of a small quantity of air to maintain aerobic conditions. This would seem to be more easily applied to a small plant than to a very large one like that at Milwaukee, although if the saving in operating expense is sufficient, the size of the plant would probably not offer an insurmountable obstacle to the adoption of such a method.

At present the hope of improving the method of dewatering appears to lie in the direction of conditioning the sludge rather than improvement of mechanical appliances, although the latter subject should by no means be neglected.

Recent Legal Decisions

MOTIVES OF MUNICIPAL OFFICERS AND VOTERS CANNOT BE JUDICIALLY INVESTIGATED IN INJUNCTION SUIT

The Supreme Court of the United States holds, Detroit United Ry. v. City of Detroit, 41 Sup. Ct. 285, that the motives of the officials of a municipal corporation and of the electors in adopting an ordinance to construct a municipal street railway after the expiration of the franchise of the existing street railway company, are not proper subjects of judicial inquiry in a suit for injunction by the street railway company, so long as the means adopted for submission of the question to the people conformed to the requirements of the law.

PARTY TO ILLEGAL MONOPOLY CANNOT, WHEN OVERREACHED, RECOVER STATUTORY PENALTY

In an action to recover a statutory penalty provided by Indiana Burns' Ann. St., 1914, par 3872, it appeared that the specifications for pavements were drawn so as to require the use of a road binder of which the defendant had a monopoly, and the plaintiff bid on the work on those specifications on the defendant's assurance that it would furnish the binder at six cents a gallon; but it "boosted" the price on him. The Indiana Appellate Court held, Moore v. Barrett Co., 130 N. E. 649, that the plaintiff contractor could not recover the statutory penalty, notwithstanding that the arrangement between the defendant and the board of county commissioners and others was in furtherance of a monopoly, and so criminal under sections 3866 and 3868 of the Indiana statutes. The plaintiff knew all the time that the whole transaction was illegal and void, and he could have repudiated the entire matter, had he chosen to do so. His purchases of the material were, under the facts alleged, purely voluntary.

RATE OF COMPENSATION AS DEPENDENT ON TIME OF COMPLETION OF WORK

A drainage contract provided that if the work be performed prior to January 1, 1918, the contractor should receive the sum of 11¼ cents per yard, but if not performed prior to that date he should receive the sum of 9¾ cents per yard. The work was not completed by January 1, nor for some time thereafter. The Minnesota Supreme Court holds, Frederick v. Redwood County, 182 N. W. 514, that the plaintiff was entitled to the lower rate of compensation only. The reduction from 11¼ to 9¾ for the failure to complete the work within the stipulated time is not to be construed as a penalty for a breach of the contract and is therefore valid. The allowance of the higher rate was evidently provided for as an inducement to extra exertions in the performance of the contract; the lower rate being intended as the agreed compensation.

CONTROVERSY OVER CONTRACT HELD SUFFICIENT CONSIDERATION FOR NEW CONTRACT

The Iowa Supreme Court holds, Horton Tp. v. Drainage Dist. No. 26, 182 N. W. 395, that a controversy between a drainage contractor who had not completed the parts of the work which he had commenced, and the county board of supervisors, as to who was in default, he not having been paid in money as provided by the contract, nor given an extension claimed, on account of unavoidable scarcity of labor, and the board having prematurely served notice of cancellation of the contract, was sufficient to constitute a consideration for a compromise contract by which he was to finish the work begun and be released from the rest.

ORDINANCE AUTHORIZING LAYING OF TRACKS AND REQUIRING PAVING IMPOSES OBLIGATION ON ACCEPTANCE

In an action by a municipality against a street railway company for payment of the expenses of paving between the rails and tracks of the company, and three feet on each side thereof, the New Jersey Court of Errors and Appeals holds, Borough of Merchantville v. Camden & S. Ry. Co., 113 Atl. 136, that a railway company, having accepted an ordinance granting permission to lay its tracks on a public highway in its entirety, must accept the burdens. It cannot accept the benefits and reject the burdens. This is so, even when the work done by the municipality, from which the obligation arose, was ultra vires. A railway company cannot stand by and see public work done, for which it may be liable, under a resolution, and then raise the question of the propriety of the procedure collaterally, viz., that the work should have been done under an ordinance, and not by resolution.

DEPARTURE FROM PAVING SPECIFICATIONS RESULTING IN LACK OF SUBSTANTIAL PERFORMANCE BARS RECOVERY

Where a paving contractor's departures from the specifications resulted in pavements which would "disintegrate and wear out many years before they should had they been built in accordance with the specifications," there is no substantial compliance with the contract. That being so, the Pennsylvania Supreme Court holds, Wright v. Barber, 113 Atl. 200, that the contractor could not recover even for the work done, for any other conclusion "would tend to demoralize the whole country." And where it was found that it would cost more than the balance of the contract price to put the work in the condition provided by the contracts, a taxpayers' bill to enjoin further payments under the contracts was sustained.

AGREEMENT WITH MAYOR DOES NOT BIND CONTRACTORS TO SUBMIT TO ARBITRATION

An agreement between the mayor of a city and contractors with the city that the council is to decide what amount, if any, is still due the contractors, is not sufficient to amount to a submission to arbitration, so as to prevent suit by the contractors for the balance claimed.—Johnson v. City of Prineville. Oregon Supreme Court, 196 Pac. 817.

NEWS OF THE SOCIETIES

Aug. 10-12—INTERNATIONAL ASSOCIATION OF STREET CLEANING OFFICIALS. Annual conference. Hotel La Salle, Chicago, Ill.

Aug. 23-25—AMERICAN ASSOCIATION OF PARK SUPERINTENDENTS Annual meeting. Detroit, Mich. Secretary, Emmet P. Griffin, Superintendent of Park, East St. Louis, Ill.

Aug. 30-Sept. 1—MICHIGAN STATE GOOD ROADS ASSOCIATION. Annual meeting. Flint, Mich.

Sept. 13-16—NEW ENGLAND WATER WORKS ASSOCIATION. 39th annual convention. Bridgeport, Conn. Secretary, Frank J. Gifford, 715 Tremont Temple, Boston, Mass.

Sept. 28 (10 days)—NEW YORK ELECTRICAL EXPOSITION. Seventy-first Regiment Armory, New York City.

October—IOWA SECTION OF THE AMERICAN WATER WORKS ASSOCIATION. Seventth annual meeting, Omaha, Neb. Secretary, Jack J. Hinman, Jr., State University, Iowa City, Ia.

Oct. 5-7—SOCIETY OF INDUSTRIAL ENGINEERS, National convention. Springfield, Mass.

Oct. 1-15—LYONS FAIR FOR PROMOTION OF INTERNATIONAL TRADE. Lyons, France.

Oct. 11-14—INTERNATIONAL ASSOCIATION OF FIRE ENGINEERS. Annual Convention, Atlanta, Ga. Hotel Ansley. Secretary, James J. Mulcahey, Municipal Building, Denver, Colo.

Oct. 24-28—AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS. Annual convention. Southern Hotel, Baltimore, Md. Secretary, Charles Carroll Brown, Valparaiso, Ind.

Oct. 31-Nov. 5—NEW ENGLAND ASSOCIATION OF COMMERCIAL ENGINEERS. Power show in connection with INTERNATIONAL TEXTILE EXPOSITION. Mechanics' Building, Boston, Mass. Secretary, James F. Morgan, Devonshire st., Boston.

Nov. 14-18—AMERICAN PUBLIC HEALTH ASSOCIATION. Annual meeting. New York City.

AMERICAN ENGINEERING COUNCIL

On June 3, the membership of the American Engineering Council included twenty-seven member organizations, two other societies have since made application for membership, and other engineering organizations have the question of joining the Federation under serious consideration.

Service has been accepted by 58 men on the following nine committees: Military Affairs, Payment for Estimating, National Board of Jurisdictional Awards in Building Industry, Classification and Compensation of Engineers, Cooperation with American Institute of Architects, Types of Government Contracts, Patents Committee, New York State Government Reorganization, Licensing and Registration of Engineers.

The most important committee work of council at the present time is the study of Elimination of Waste in Industry. It is contemplated that the report of the committee will be ready for general distribution early in September. Special committees recently appointed are a Foreign Relations Committee, a Committee on the Employment Service, and American Engineering Congress Committee. The standing Committee on Procedure and the Committee on Public Affairs are constantly being called upon for the guidance of the work of Council.

Under the direction of the latter committees council is actively at work in advancing the plans for a National Department for Public Works, to help improve the status of public health engineers, to obtain equitable engineering research legislation, co-operating with the American Engineering Standards Committee, working for the appointment of engineers to engineering positions in the federal government, support for topographic mapping program, etc. A special employment committee has under consideration a definite plan for improvement and extension of the service, whereby it is contemplated that special arrangements will be made to care for the interest of constituents of member organizations in the present employment crisis and that general plans will be adopted and put into operation whereby this service will be of the greatest possible direct value to every member organization.

The American Engineering Congress Committee is at work planning for the Engineering Congress which is to be held in connection with the annual meeting of A. E. C.

PERSONALS

King, Lt.-Col. Frank B., has been placed in charge of the water and sewer extensions at Duncan, Okla., for V. V. Long & Co., Oklahoma City, Okla.

Moorefield, Charles H., has been appointed state highway engineer of South Carolina.

Hays, James P., has been appointed general superintendent for the Austin Co., Cleveland, Ohio, on the construction of a $250,000 soldiers' memorial auditorium at Mount Union College, Alliance, Ohio.

Roe, Dr. Joseph W., has been appointed professor of industrial engineering of the New York University.

Hewes, Charles E., has been appointed city manager of Long Beach, Cal.

Hickok, Major Clifton E., has been appointed city manager of Alameda, Cal.

Wehrung, J. Powell, has been appointed county engineer of Runnels county, Texas.

Limerick, R. C., has been appointed state highway engineer of the Arkansas Highway Commission.

Brock, William F., has been appointed highway engineer with the United States Bureau of Public Roads at Jackson, Miss.

Shaw, Arthur M., will supervise the design and construction of a complete sanitary sewer system at San Pedro Sula, Honduras, C. A.

Leonard, Offie, has resigned his position as office engineer of Travis county, Texas.

Buck, C. D., has been appointed assistant state highway engineer of Delaware.

Welborn, W. C., has become city engineer of Paris, Texas.

Woodworth, Dr. Philip, has been appointed president of Rose Polytechnic Institute, Terre Haute, Ind.

Davis, E. W., will act as city engineer of Longview, Texas.

Hengst, M. C., has been appointed highway engineer of Barry county, Mich.

Howe, Harry N., has been appointed commissioner of streets of Memphis Tenn.

McCanlies, L. C., has resigned as county engineer of Callahan county, Texas.

Laird, L. E., has been made state highway superintendent of Wyoming.

King, W. J., has resigned as county engineer of Labette county, Kansas.

Brewer, T. M., has been appointed city engineer of Viroqua, Wis.

Chambers, John, has been appointed chief engineer and superintendent of the Louisville Water Co., Louisville, Ky.

Higgins, Lafayette, has resigned as state sanitary engineer of the Iowa State Board of Health.

Manley, R. G., has been appointed superintendent of streets and city engineer of Upland, Cal.

Reid, Joseph Y. L., has been appointed superintendent of the filtration plant at Trenton, N. J.

Mylchreest, Joseph W., has been appointed city engineer of Middletown Conn.

Kringel, August E., has been appointed city engineer of Green Bay, Wis.

Rogers, C. J., has been appointed county engineer of Jefferson county, Ala.

INDUSTRIAL NOTES

SULLIVAN MACHINERY CO.'S NEW OFFICE

The Cleveland office of the Sullivan Machinery Company was moved on July 1 from 810 Park building to Room 824, Kirby building. Ralph T. Stone is manager at Cleveland.

The Sullivan Machinery Company announces the establishment of a supply depot and service station for coal mining machinery supplies and repair parts at Seventh avenue and 13th street, Terre Haute Ind., with H. T. Wiley, formerly of the engineering department at the Claremont, N. H., works in immediate charge.

William H. Okum has been appointed vice-president and works engineer of the Superior Wood Heel Co., Brooklyn, N. Y.

The Badger Concrete Mixer Co., Milwaukee and Watertown, Wis., will erect a factory at Winthrop for the manufacture of Badger concrete mixers and McVicker tie plates for the Railway Safety Tie Co.

Horace M. Bringhurst is sales engineer in charge of the steel lumber department of the General Iron Works Co., Cincinnati, Ohio.

The Pacific Coast Concrete Co. has its new offices at 827-29 Pacific Mutual building, Sixth and Grand avenues, Los Angeles, Cal.

J. F. Hall-Martin Co. have their offices now at 229 Douglas building, Los Angeles, Cal.

The Red River Valley Concrete Products Company has a new factory in Crookston, Minn.

Hartley Rowe has been appointed manager of the Boston office of the Lockwood, Green & Co.

New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations

NEW P & H SKIMMER COOP

A new skimmer scoop has been put on the market by the Pawling & Harnischfeger Co., of Milwaukee, to be used with either of the 205 or 206 P & H excavator cranes. This mav be attached in place of the standard boom in a manner similar to the shovel attachment,

BOOM HORIZONTAL; BUCKET EXCAVATING SURFACE CUT

which was brought out early this spring. The development of this skimmer scoop broadens the field of application of P & H excavator cranes, allowing the contractor to keep down his investment in machinery.

The illustration, Fig. 1, shows the skimmer scoop on the full corduroy 206 machine working on a grading job on

BOOM ELEVATED AND REVOLVED TO DISCHARGE CONTENTS OF BUCKET INTO WAGON

Hawley road, Milwaukee county, Wisconsin. Here the bucket is shown, in one view, at the end of the travel along the boom while the other view shows the boom elevated and the load being dumped into a wagon.

That this type of road-making machine is of real value is shown by the record of Wm. Datka, Milwaukee, contractor for the Hawley road grading job, who effected a saving of $83.44 per day and executed the work in shorter time by the use of the machine.

General Data—Number of days on job, 8; total cubic yards excavated, 2,578 cubic yards; total hours worked, 79 hours; excavated per hour, 32.6 cubic yards; number of days saved in using machine in place of wheelers and plows, 2 days.

Classified operating costs:

Total cost per day operating with skimmer scoop, including interest and depreciation (assuming 5 years life of machine)	$ 91.25
Number of days operating	8
Total cost	730.00
Total cost per day with wheelers, scoops and plows	130.00
Number of days (estimated)	10¾
Total cost	1,397.50
Total cost with skimmer scoop	730.00
Difference	$667.50

MOTOR TRUCK TRAILERS

Motor truck trailers manufactured by the Detroit Trailer Co., are described in a 32-page catalog that profusely illustrates 4-wheel models B and D, reversible and non-reversible 4-wheel drop frame trailers, trailers of 1½ to 15 tons capacity, Model C trailers for light work and semi-trailers of from 3 to 15 tons capacity. Among the distinctive features of the trailers are the bell shape draw head with a positive cam latch which eliminates looseness, assures alignment and provides instantaneous connection with the truck.

The steering arm is attached to the axle and compels the trailer to follow the line of the truck. The wheels are kept parallel by an independent tie-rod connecting the drag link and the knuckle steering arms. When the draw bar is swung to the center of the frame the wheels are automatically locked parallel to the frame. The springs are double shackled.

The model D, drop frame trailer can be hauled either by horses or motor trucks and is efficient for handling garbage, ashes and street cleaning where the material is picked up by horses and the long distance hauling is done with motor trucks or tractors. More than two-thirds of the loading can be done with the body tilted to a loading height of 48 inches or less. It is made in six sizes of 2 to 5 yards, water level capacity and may be fitted with any special bodies ordered.

Various standard types of bodies of different capacities are made to dump at the side or end. Trailers made in five sizes with capacities of 1 to 8 tons, are designed for a swivel bolster, a single stationary bolster, double bunkers or bolsters as required. For hauling very long material a bolster can be provided to go on the truck patform and let one end of the load rest on the truck bolster and the other end rest on the trailer.

SEGMENT SEWER BLOCKS, SEWER PIPES AND FITTINGS

Segment sewer blocks manufactured by the Robinson Clay Product Co., are distributed from offices and yards in New York, Chicago, Boston, Buffalo, Syracuse and Toronto. The segment blocks, pipes and other fittings of this company are made of vitrified Ohio shale and clay, highly glazed and impervious to water and chemical action. They are of ample strength and have well bonded scarified joints filled with cement mortar. An especial advantage is that the first line of blocks laid in the invert of the sewer automatically produces a perfect subdrain.

Standard segment blocks are provided for diameters of 30 to 108 inches with respective thicknesses of 4¾ to 10½ inches and corresponding weights of 250 to 1930 pounds per lin. foot.